THE TRANSPLANTATION OF THE THYROID GLAND IN DOGS.

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Highly organized tissue cannot as yet be permanently transplanted from one organism to that of another. So much may be gleaned from the mass of material presented during the past four years by the various experimental workers in transplantation.

There is much laboratory and clinical evidence, however, that the implantation of large fragments of bony tissue is practicable. Albee reported 253 cases of autografts of bone, a large percentage of which were successes, and he concluded that the bone graft is reliable when taken with its enveloping membranes and contacted with bone. McWilliams has also recently shown the importance of the periosteum in transplanting the larger grafts of bone. Some discussion has arisen, it is true, as to the fate of the bone transplant. Borth now agrees with Axhausen, Phemister, and Lewis that the compact bone of the graft is absorbed and that it is replaced by bone formed by the periosteum and endosteum of the graft. Lewis holds that compact bone dies in the graft because of its physical properties which do not permit rapid enough absorption of serum to maintain the life of the bone until the vascular circulation is reëstablished.

Mauclaire reported five successful results out of a number of failures. He believes that if the successes of Küttner and Lexer in the transplantation of articular fragments taken from the cadaver are multiplied that such transplantations will give much better results than the best of resections. Cohn and Mann reported from their fifteen experiments that isolated bone grafts did not act as foreign bodies, nor were they absorbed after sixty days, even showing a tendency to outgrowth. According to MacEwen, if small grafts of compact bone could be used the bone would live, but, as Lewis stated, this ideal condition is rarely, if ever, secured in bone transplantation.

Lexer reported that although Schoene has carried out successfully skin transplantation in animals of the same litter and the same sex, that he himself has never seen any successful homoplastic skin grafts in man even between close relatives.

Erlacher succeeded in the transplantation of muscles, for after ninety-nine days the electrical tests showed that the transplanted muscles reacted normally to stimulation. But his experiments in the free transplantation of nerves were failures, although restoration of the peripheral part of the nerve took place after section.

Von Hacker has recently implanted the central stump of the accessory nerve directly into the trapezius in a case of paralysis of that muscle as a result of injury to the accessory nerve. The result was excellent.

Stich stated, in 1913, that arteries and veins which have been autoplastically transplanted will retain their vitality and become an integral part of the system. The different layers are microscopically shown to be completely intact, but when transplanted to different animals, and more especially when transplanted to animals of different species, they show a replacement by the tissues of the body to which they were transplanted.

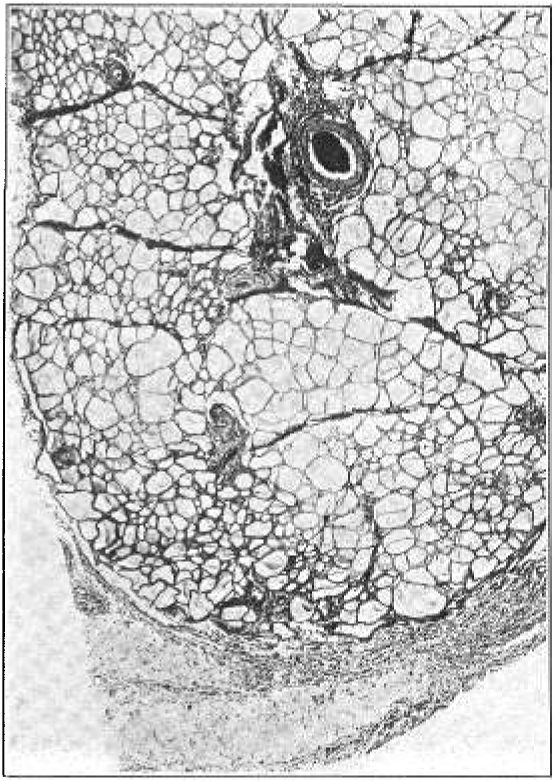

FIG. 1.—Dog No. 132. Autotransplantation thyroid with carotid and thyroid vessels. No thrombosis of vessels. Thyroid in normal state of preservation.

Parenchymatous organs of a more highly physiological function, such as the kidney, spleen, thyroid, etc., when transplanted into another animal, undergo autolysis and are eventually absorbed. The longest time a kidney has continued to functionate in an animal of the same species is three months (Stich, Ingebrigtsen).

Nemiloff found in transplantations on dogs that pancreatic tissue transplanted either as autografts or homoplastically, subcutaneously or intra-abdominally is for the most part absorbed in the course of a few days and that a thin zone of living parenchyma remains only at the edge of the transplant. This is more pronounced in homoplastic experiments. The longest interval of survival of any part of the transplant was fourteen days.

Crowe and Wlislocki, in their experimental work in suprarenal glands in dogs, found in several instances normal-looking viable cells of the cortex after transplantation, but the majority of grafts underwent degenerative changes and were eventually replaced by scar tissue; in any event the chromaffin elements entirely disappeared. The authors attributed these changes to the lack of nerve supply to the graft.

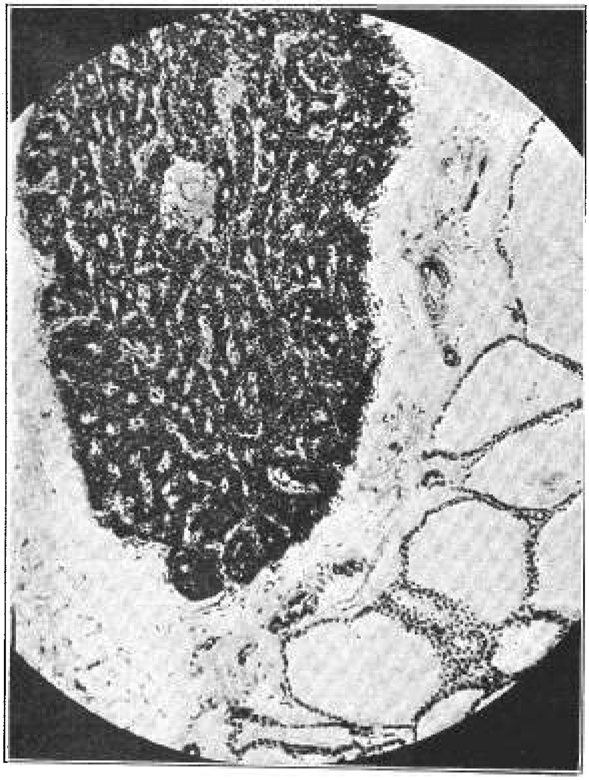

FIG. 2.—Dog No. 142. Homotransplantation of thyroid gland with carotid and thyroid vessels. Shows parathyroid in perfect preservation, but does not show how many oxyphil cells it contains. Vessels preserved in their normal state. Thyroid fairly well preserved.

Lexer remarked at the International Surgical Congress in New York, 1914, that he had been able to overcome some of the biochemical differences in animals by prolonged treatment of the host with serum and tissue taken from the donor. By these means skin transplants lasted considerably longer; in some cases even for six weeks. He considered that the prospects of improving homoplastic surgery were most hopeful along this path.

James B. Murphy found that if portions of the spleen were transplanted with the malignant tumor transplant that the growth of the latter was retarded. He reasoned, therefore, that if the activity of the lymphatic system could be temporarily retarded that the chances for the permanency of the transplant would be materially increased. He suggested either the application of Roentgen rays or the internal administration of benzol for this purpose.

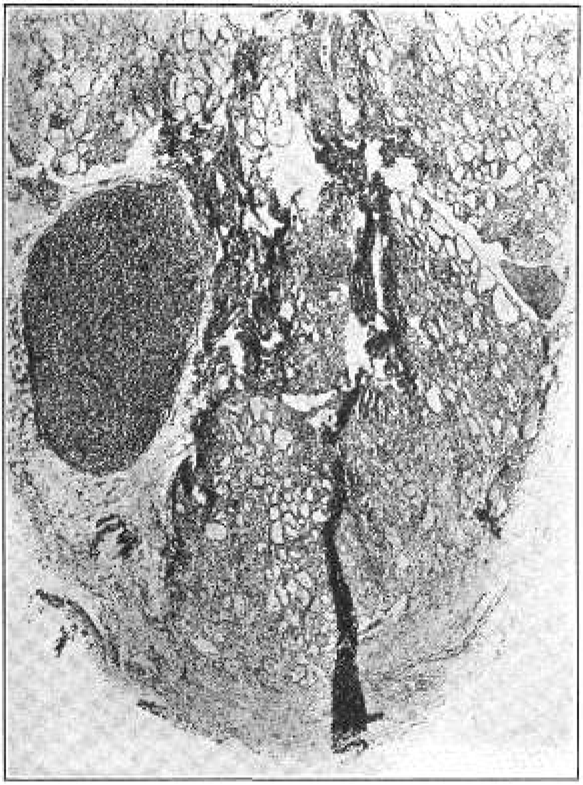

FIG. 3.—Dog No. 199. Homotransplantation thyroid with carotid and thryoid vessels. Colloid absent. Follicles extensively shrunken and destroyed. The parathyroid is not very well preserved, but shows no connective-tissue proliferation nor vessel changes.

Among the more recent attempts at transplantation in human beings the more remarkable are those of Tuffier, Kocher, Lydston, Payr, and Küttner. Tuffier did 204 ovary transplantations in which the autografts were only successful in women under forty years of age. In 4 cases Tuffier removed human autografted ovaries from two to three years after they were transplanted, and found incontrovertible evidence that they had been functionating. Tuffier concluded, however, that when the uterus is absent, ovarian transplantation is of no value.

G. F. Lydston, in his experiments with the testicle, had surprising results in therapy, but his transplants did not long survive.

Marine has demonstrated on rabbits that specific secretory nerve fibers are not essential in transplants in order that thyroid tissue may exhibit the characteristic morphological and physiological changes known to be associated with great variations in functional activity.

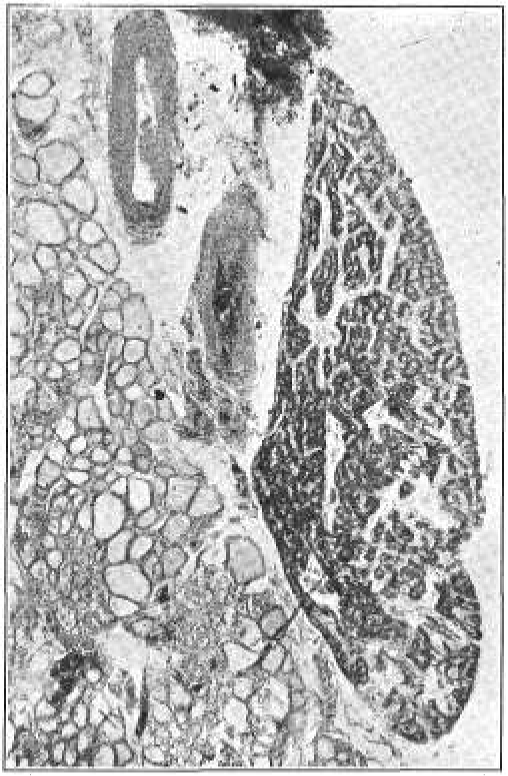

Fig. 4.—Dog No. 202. Homotransplantation of thyroid gland with segment of carotid and the thyroid vessels. Parathyroid gland in good state of preservation. Thyroid shows evidences of beginning autolysis.

Theodore Kocher and Payr concluded that thyroid transplantation was much more effective and more rapid than that of thyroid medication, but Kocher believed that one transplantation did not suffice. Kocher also believed that the problem of ensuring the permanency of the transplant might be solved by finding ways of decreasing the recipient's immunity and of performing the transplant in the presence of an infection.

Stich found that thrombosis of the thyroid veins was a menacing factor. When this occurred, some time after the transplantation, there was some chance of vascularization from the surrounding tissue; otherwise the transplant was lost.

With a view of throwing some light on the causes of failure in the transplantation of organs, we chose the thyroid gland for our experiments on account of its accessibility and the readiness with which it offers itself to reimplantation with a restoration of its circulation by the aid of bloodvessel suture. We found that we were able to overcome the difficulties of venous stasis and thrombosis by adopting the technic already referred to in *Annals of Surgery*, December, 1914. This technic consists briefly in an implantation of the thyroid gland underneath the muscles of the neck and a biterminal suture of a segment of the attached carotid of the severed vessel of the host and end-to-end suture of the thyroid vein with the central end of the external jugular of the opposite side.

TRANSPLANTATION OF THE THYROID GLAND WITH A SEGMENT OF CAROTID ARTERY

Dog No.		Condition of carotid.	Duration of life.
132	Autotransplant	No thrombosis	23 days
138	“	“	24 hours
142	Homotransplant	“	12 days
147	“	“	14 “
148	Autotransplant	“	4 “
157	Homotransplant	“	44 “
164	“	“	42 “
174	“	“	6 “
186	“	“	10 “
192	“	Partial thrombosis Gland absorbed	79 “
199	“	Thrombosis	4 “
208	“	No thrombosis	2 “
242	“	“	5 “
262	“	“	3 “
269	“	“	7 “
274	“	“	3 “
38	“	“	5 “
58	“	“	10 “
77	“	“	9 “
98	“	“	4 “
107	“	“	5 “
124	“	Partial thrombosis	4 “
180	“	No thrombosis	61 “
191	“	Thrombosis	49 “
202	“	No thrombosis	8 “
225	“	“	21 “
229	“	“	14 “
239	“	Partial thrombosis	7 “
283	“	Gland absorbed No thrombosis	53 “
214	“	No thrombosis	112 “

During the months of October and November, 1914, we had a series of postoperative hemorrhages. A microscopic examination disclosed a traumatic rupture of one of the lines of suture. Investigation proved that these hemorrhages were brought about by accidental fighting between the animals.

In Case 202 the carotid was smooth, the superior thyroid artery, the thyroid and external jugular veins were patent, and the gland and the transplant were normal in color and appearance. The capsule was smooth and freely movable. Death was due to pneumonia. The pathological report by Professor Symmers was as follows:

"The upper portion of the thyroid reveals the presence of numerous vesicles containing colloid, the interstitial tissues are not increased in thickness, and the gland appears to be normally vascularized. The lower portion of the thyroid shows the presence of a relatively low proportion of colloid-containing vesicles. The majority of the vesicles are empty of colloid. They are lined with a rather low cuboidal epithelium which in many places have undergone proliferation, partially filling the lumen of the vesicle. The desquamation of the epithelium occurs in places. The interstitial tissues do not appear to be thickened. The parathyroid gland is apparently well preserved."

There was not, in the entire series of 30 operations, a single instance of infection. In 12 of these cases, intratracheal anesthesia with the Janeway intratracheal apparatus was used. In the remaining cases ether was administered with an Allis inhaler.

We have had three instances among our homotransplantations in which the parathyroid gland remained in a normal state of preservation while the thyroid gland showed evidences of autolysis. In autotransplantation we have succeeded in two consecutive instances in retaining the thyroid gland in its normal state microscopically. On the transplanted bloodvessels we have made the following observations: In 25 out of 30 instances the segments of the carotid artery remained free from thrombosis and in 4 instances the superior thyroid artery also remained patent and without any evidences of thrombosis, although the gland transplanted has undergone autolysis and was partly absorbed. The histological findings of these specimens will be reported in a subsequent article.

We agree with Stich, Borst, Enderlen, Carrel, Lexer, and Jeger that autotransplantation is practicable. After homotransplantation the transplant of a bloodvessel will retain its life for an indefinite length of time while more highly organized tissue of a more complicated physiological function will remain intact for a short time only, from two to four weeks, and will then show evidence of absorption. In the absence of hemolysis and agglutination the life of the transplant of even more highly organized tissue may be prolonged. We must conclude that up to the present time we have no means of prolonging the life of an organ transplanted from one animal to another indefinitely.

Thanks are due to Dr. I. Seff and to Dr. S. Berkowitz for valuable assistance.

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GASTRIC FUNCTION IN PULMONARY TUBERCULOSIS.[1]

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The importance of a study of the gastric function in pulmonary tuberculosis can scarcely be overestimated when we consider the

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[1] Read before the National Association for the Study and Prevention of Tuberculosis, Washington, D. C., May 12, 1916.